

The book is well and clearly printed, and has been extremely well edited. The only printer's error noted was in the title of Mr. Oldfield Thomas' paper on p. 318. E. B. P.

TEXT-BOOK OF AGRICULTURE.

Advanced Agriculture. By H. J. Webb, Ph.D., B.Sc. (Lond.). 8vo., pp. vi. and 672. (London: Longmans, Green, and Co., 1894.)

TEXT-BOOKS of agriculture are rapidly increasing in number. The name of the author on the title-page of this is that of the late Principal of the Agricultural College at Aspatria, Cumberland, who, most unfortunately, was unable to complete the work. He was struck down at a comparatively early age, and in the midst of hard work and a successful career. He is most highly spoken of, and deservedly so, in the preface by the editor of the book, Mr. J. Lister, of Aspatria. From such hands we anticipated much and good work, though the task might appear heavy. We regret to say that we have been greatly disappointed.

We are told that—

"This work, though primarily intended for the advanced stage of the Science and Art Departments' Examination in Principles of Agriculture, will also cover the greater part of the syllabus of the Honours stage. Care has, however, been taken not to adhere too rigidly to the syllabus in question, and we trust it may be found equally serviceable for the examination for the diploma in Agriculture of the Highland and Agricultural Society in Scotland, and the senior examination of the Royal Agricultural Society of England."

Even the fact that the book has been prepared mainly to assist students to pass examinations, can hardly excuse some of the statements we meet with. In agricultural geology we are told, among other scraps of information that zeolites are "hydrated silicates of alumina or lime." This is scarcely true. "Diorite consists of plagioclase and hornblende." This is true, but as the meaning of plagioclase is nowhere explained, it does not help the student much. In agricultural physics we learn that "a heavy soil might contain absolutely double the amount of phosphoric that a light soil did, although it would show only the same percentage if it were twice as heavy." We have tried to believe this, but till now we do not understand it. In engineering, a definition of horsepower is given without any mention or suggestion of time as a possible factor.

In chemistry, Rendonda [Redonda] and Alta Vela phosphates are said to contain a large quantity of *alum*; leather to contain $4\frac{1}{2}$ to 9 per cent. of *ammonia*, and meat-meal and meat-guano to contain much *ammonia*. This is the more confusing, as in other manures, mentioned on the same page, the percentage of *nitrogen* is correctly given; but this confusion of ammonia with the ammonia equivalent of the contained nitrogen is common throughout. Ammonium chloride is said to contain about $18\frac{1}{2}$ per cent. of water and $32\frac{1}{2}$ per cent. of ammonia. The formula of monocalcic phosphate is correctly given as $\text{CaH}_4\text{P}_2\text{O}_8$, and tricalcic phosphate as $\text{Ca}_3\text{P}_2\text{O}_8$, and, yet, in one analysis 18.01 per cent. of the former is said to be equal to 28.1 per cent. of the latter, and in another case 19.2 per

cent. of monocalcic phosphate is said to be equal to 30.07 per cent. of tricalcic phosphate made soluble: of course the so-called monocalcic phosphate in these analyses is calcium metaphosphate, formerly known as "biphosphate"; but how can the student know this? Cellulose is described as a white amorphous powder.

In agricultural botany, we are told that "protoplasm generally presents itself as a granular semi-fluid substance with or without a cell-wall." "The corolla, when present, usually consists of green leaves or sepals, sometimes scarcely noticeable." This later statement is, of course, only a misprint; but it is also only an example of several similar serious misprints.

The root residues of crops remaining in the soil are said to "consist very largely of protoplasm." The section on farm crops, however, in which this occurs, is written in a curious style, somewhat difficult to follow.

On looking up information regarding anthrax, we find that "although a disease of the blood, the writer [in this case Mr. H. Thompson] considers it more of a dietetic nature, having seen it produced from steeped brewers' grains allowed to stand till they had reached the acetous stage of fermentation. It is also produced by the hay bacillus, obtained from the fermentation of chopped hay and from mouldy cotton-cakes, more particularly the undecorticated variety. He has also seen it arise in certain undrained lands. Although very fatal to other animals, such as dogs, cats, and poultry, that may have eaten the flesh or blood, yet he considers it neither infectious nor contagious, having never known it to extend beyond the buildings in which it originated. Again, the disease was always traceable to some peculiarity of the feeding, and the writer thinks that it is analogous to an aggravated form of *red water*." And this stuff is set forth as *advanced* agriculture. There are several very startling statements in the chapter on veterinary science; e.g. in retention of the foetus, "different bones belonging to the foetus, such as jaw, scapula, ribs, humerus, and several others, are passed at times through the rectum."

In the chapter on agricultural entomology, we hardly suppose the author is serious when he recommends the use of rape-cake, at the rate of two or three tons per acre, to clear the field of wire-worms.

In part ii. of the book the misstatements are perhaps not quite so numerous or so serious, but they are not absent. In the chapter on permanent pastures, after a notice of the power which leguminous plants, with the aid of the low organisms present in the nodules on their roots, possess of appropriating free nitrogen, we are told that "this fact of the nitrogen-storing power of the leguminous plants explains the action of heavy dressings of nitrogenous manures on permanent pastures encouraging the growth of grasses, especially the coarser ones, at the expense of the clovers." We fancy that this *explanation* of the fact will not satisfy many readers.

The work of Rothamsted is frequently referred to and fully appreciated; but why should Rothamsted be spelt in three different ways in the book? Probably, however, every would-be advanced agriculturist knows that there are not three Rothamsteds.

But we have given enough instances of what are very serious flaws in the book. Much of the matter is exceedingly good and useful; but does not this really add to the

danger of the work in the hands of the learner who is not in a position to sift the wheat from the chaff and the weeds?

We do not think that this book will serve to advance the reputation of its author, nor to advance agriculture. We submit that "advanced agriculture" is not agriculture *plus* a smattering of chemistry, a dip into geology, a pinch of botany, a skim of entomology, a sniff at meteorology, and so on; even if the sciences be correctly expounded. The text-book of agriculture, like that of other subjects, has no doubt to pass through stages of evolution, and we trust it will not long remain at the stage indicated by this book.

EWING ON THE STEAM ENGINE.

The Steam Engine and other Heat Engines. By Prof. J. A. Ewing, M.A., B.Sc., F.R.S., M.Inst.C.E. (Cambridge: The University Press, 1894.)

ENGINEERING students and others will welcome the present volume as one likely to increase their knowledge of an important branch of engineering, from the pen of an acknowledged master of the science; any work by Prof. Ewing is sure to be read by engineers generally, and treated as a book for constant reference.

As is well known, Prof. Ewing wrote some valuable articles for the "Encyclopædia Britannica" on this subject, and it is an expansion of these articles which constitutes the basis of this work. As a University text-book this volume will fill a great want, treating as it does, from the theoretical side, a subject only descriptively dealt with in the majority of such text-books. As the author remarks: "The endeavour throughout has been to make evident the bearing of theory on practical issues."

The first six chapters may be said to contain the early history of the steam engine, and a scientific treatment of the general behaviour of steam in the cylinder, as well as the general theory of heat engines. The information thus brought together is of a valuable nature, and the references which are made, add considerably to the usefulness of the work. To the thoughtful practical engineer, this portion of the book will form a perfect mine of matter for careful consideration.

The testing of steam engines has of late years become a common occurrence, thanks to Profs. Kennedy, Osborne Reynolds, and many others. Designers and manufacturers of such engines have everything to gain by such experiments; few being, like the late Mr. Willans, capable of carrying out scientifically accurate trials of their own engines. Chapter vi. deals with this important question. Many useful hints are given, and sources of error carefully pointed out. As indicator diagrams play such an important part in the trials of steam engines, it is interesting to note that the Crosby Company's modified form of Richards' Indicator is considered by Prof. Ewing to be one of the best.

Compound expansion comes in for very full and accurate treatment; many sets of indicator diagrams are explained and illustrated, and the difficult matter involved in the combination of such diagrams is lucidly dealt with. Of the advantages of compound expansion in the

use of high-pressure steam, we are told much, and also of the mechanical advantages of such an arrangement. We cannot help pointing out that, in this matter, the practical men on the Clyde were singing the praises of compound engines before the theoretical men would admit of their utility or economy. On valves and valve gears our author has much to say, although we notice nothing remarkable in the chapter. Locomotive engineers do not trust entirely to the drawing-board or calculation in the design of valve gears. It is now the practice to try the proposed gear as a full-size model on the valve gear testing machine, and so to obtain the best results. The latest machine of this kind has been erected in the drawing-office of Messrs. Sharp, Stewart, and Co., the eminent locomotive engineers, of Glasgow. The saving of time is great, and very accurate results are obtained. In fact, in such drawing-offices, the old valve diagrams, with their many curves, are things of the past, and a simple table of leads, cut-offs, suppressions, &c., for the different degrees of expansions, has taken their places.

Chapter ix. treats of the many forms of governors used for regulating the work done in the steam engine, commencing with Watt's simple arrangement, and finishing with the differential or dynamometric governors invented by the late Sir W. Siemens; and further on in the book we find much useful information concerning the work on the crank shaft. Diagrams of crank efforts are given, and the effect of friction and of the inertia of the reciprocating pieces are duly discussed. The balancing of machinery is an all-important subject, in fact the life of any machine depends upon the balancing of its moving parts; for this reason, we are sorry to see that Prof. Ewing has so little to say on this subject generally, and particularly on the balancing of locomotives. If theory is of any help to the locomotive engineer at all, surely it could be best applied in balancing; some engineers balance the whole reciprocating weight, others none; the majority about 30 per cent.: which is right. Prof. Ewing does not help us, but observes that "the final adjustment of the balancing masses is usually a matter of experiment, the locomotive being hung in chains to allow its oscillation to be observed"; this, to say the least of it, is never done in this or any other country.

The production of steam is the subject treated in the following chapter; the illustrations of the different boilers, with the descriptions, are excellent. The only specimens of water-tube boilers illustrated are the Thornycroft and the Babcock and Wilcox, the latter used principally for stationary engines. The Thornycroft boiler is the forerunner of similar types; for instance, the Yarrow and the Clyde among others, all of which are considerably lighter than the ordinary marine boiler. As an example of the locomotive boiler, one of the London and North-Western Railway Company is taken as typical of British practice. As an example of an injector for feeding boilers, an old-fashioned type of Giffard injector is illustrated, but more recent types are described. Mechanical stoking and the use of liquid fuel are also mentioned.

The following chapters conclude the work, occupying some sixty pages with descriptions of forms of steam engines, air, gas, and oil engines. The Willan's central